Paper machine

The invention relates to a paper machine for the production of a paper, board, tissue or other fibrous web, comprising a press section having at least one press nip and comprising an impingement dryer arranged immediately after the press section.

DE 100 22 087 A1 discloses a press section for a paper machine comprising two press nips, through which a common bottom felt and top felt run. The second press is a shoe press, whose shoe press roll is located above the bottom roll. The pressing plane of the second roll runs substantially horizontally or inclined with respect to the vertical at an angle of at most 20°. In this press section, the bottom felt led through the two press nips is so dense that, even in the new state, it is substantially impermeable to air after wetting. The common bottom felt, on the other hand, is still sufficiently permeable to air in order to let water through in the press nips at pressures of more than six bar. The two top felts are so open that they let air through in the wetted but not compressed state. The pressing plane of the first press is inclined with respect to the vertical at an angle of more than 20°.

DE 198 41 768 A1 describes a drying section for a machine for producing a material web, in particular a paper or board web. At least one impingement dryer is provided, by means of which a hot air and/or hot steam flow can be applied to at least one side of the material web. According to some embodiments of the drying section described in DE 198 41 768 A1 (figs. 2, 4, 5), the material web coming from the press section is picked up from the press felt by a single suction roll and then led either over a single cylinder (figs. 2, 4) or over a large number of rollers (fig. 5), which are arranged substantially circularly in relation to one another. By means of these configurations of

impingement dryers, it is not necessary to lead the still relatively wet material web over smooth contact surfaces in order to achieve an adequate heat transfer.

As a result of avoiding smooth contact surfaces at the start of the drying, the risk of web breaks and the over-stretching of the edges of the web is substantially eliminated. Therefore, high drying rates are possible, which means that the overall length of the drying section is shortened accordingly. Therefore, at the start of the drying operation, the drying performance is only limited by the effect on the paper quality at an excessively high drying speed and no longer by the web guidance of the wet paper web. In addition, by using the impingement dryers, which can be regulated flexibly and quickly, the paper quality can be influenced specifically. As a result, at the start of the drying phase, the correction of transverse moisture profiles with specific heating and drying is in particular also possible.

In known paper machines, there is now the problem that, when the paper web is led through the coating unit, the strength of the paper web decreases as a result of the rewetting resulting from the application of the coating color, which can lead to web breaks. Coating processes which wipe off the excess coating color with a doctor blade therefore prove to be susceptible to faults, since a high pressure gradient occurs in this case (blade coating). As a result of this form of application, the paper is loaded highly and, because of the high tendency to breakage of the blade coating, the web speed for the online production of the paper web from the fibrous suspension as far as a paper coil wound up onto a roll is limited to 1400 to at most 1500 m/min.

The object of the invention is to provide a paper machine in which a gentle coating process can be implemented even at high web speeds.

According to the invention, in a paper machine of the type mentioned at the beginning, this object is achieved in that it has an applicator for applying a coating color in the manner of a curtain or for the film application or for spraying coating color on. This paper machine is in particular suitable for the production of LWC ("lightweight coated") paper, which is distinguished by good printability, in particular in the gravure printing sector.

By means of the combination of an impingement dryer arranged immediately after the press section with a device for the application of the coating color in the region of the drying section following in the machine running direction, the potential speed and the runnability of a paper machine can be increased considerably and, at the same time, good runnability with good paper web surfaces is achieved.

Both when using a curtain applicator and when using a film press and also in the sprayed application of a medium, in particular a coating color, the paper machine can be used up to web speeds (machine speeds) of more than 1500 m/min, preferably of more than 1700 m/min, in particular of more than 1800 m/min.

In the following text, the invention will be explained in more detail by using exemplary embodiments illustrated in the figures, in which:

fig. 1 shows the schematic structure of a press section and an impingement dryer following the latter,

fig. 2 shows an apparatus for the curtain application of the coating color,

fig. 3 shows an apparatus for the film application of coating color by means of film rolls, and

fig. 4 shows a spraying apparatus for the application of the coating color.

A press section 1 (fig. 1), out of which a paper web 2 is led, comprises, for example, two press nips 3, 4, which are each formed by a press roll 5, 6 and a shoe press roll 7, 8 interacting with the latter. The press nips 3, 4 form what is known as a tandem NipcoFlex press, as is already disclosed per se by DE 100 22 087 A1. The fibrous web 2 is guided by means of press felts 9, 10. Depending on the machine configuration and process requirements, a known transfer belt can also be used. The paper web 2 is picked up from the press felt 10 by a suction roll 11 and transferred to the circumference of a larger supporting roll 12, which is surrounded by an impingement dryer 13. The paper web 2 is led with its side opposite the impingement dryer 13 over a supporting surface that is open, that is to say is porous and not smooth. For this purpose, there is a top fabric 14. On its side opposite the supporting roll 12, the paper web 2 runs over a bottom fabric 15. Together with the latter, the paper web 2 is picked up from the supporting roll 12 by a suction roll 16. The paper web 2 then runs through a drying section of known design, such as is disclosed by DE 198 41 768 A1, for example.

In addition, for example following a calender unit arranged after the drying section, there is in the paper machine a curtain applicator known per se from DE 100 12 344 A1, designated 17 (fig. 2), which comprises a distribution chamber 18 with a discharge nozzle 19, by means of which an application medium 20 is discharged onto the paper web 2 that is moving in

the direction of an arrow L and, in the region of an impingement position P of the curtain 21, is led around a supporting roll 22.

The discharge nozzle 19 is at a distance H from the impingement position P. Over this drop height H, the application medium 20 emerging from the discharge nozzle 19 falls onto the paper web 2 substantially as a result of the force of gravity. Since the application medium 20 is accelerated over this drop distance, the thickness of the curtain 21 decreases from a value corresponding to the width D of the discharge nozzle 19 to a value d immediately before striking the paper web 2. Because of the difference between the speed of the falling curtain 21 immediately before striking the paper web 2 and the speed of the latter, the application medium is stretched once more upon contact with the latter, so that the thickness of the layer 23 applied to the paper web 2 only has the value s.

The curtain applicator 17 is arranged relative to the supporting roll 22 in such a way that the point of impingement P is arranged downstream of the vertex T of the circumferential surface of the roll 22, relative to the running direction L of the paper web 2. The angle α formed by the connecting line through the point of impingement P and the roll axis A and the connecting line through the vertex T and the roll axis A is preferably between 0° and about 45°, in order firstly to be able to prevent the application medium 20 running away on the paper web 2 counter to the running direction L of the latter and the entry of air between the paper web 2 and the application layer 23.

In another exemplary embodiment (fig. 3), the paper web 2 is led through between two film rolls 24, 25 of a film press 26 instead of the curtain applicator 17.

An applicator nozzle 27 or 28 applies a film of the coating color in excess to each of the two film rolls 24, 25, said film being doctored off by a metering rod 29, 30 in each case.

By means of the coating color used in the film press 26, the thickness of the paper web can be calibrated. Good calibration of the thickness of the coating body paper can be achieved in particular when the film press 26 operates with a coating color containing starch as a binder. As a result of the addition of the binder, misting during the application of the coating color is avoided. The proportion of binder is preferably more than 20% of the color applied. The binder used is advantageously starch.

Of advantage generally is the use of a coating color which has a solids proportion of less than 65%, in particular of less than 60%, preferably of less than 58%, measured in mass percent. By means of such a coating color, a very smooth surface of the paper web 2 can be produced.

Furthermore, the coating color preferably has a viscosity in the range from 500 to 800 Pa·s, by which means, inter alia, good processing possibilities are provided.

The coating color is advantageously also deaerated mechanically and/or chemically, in order to reduce the air content in it to less than 10%, preferably to less than 7%.

The coating color can be applied to the film rolls 24, 25 in various ways, for example by means of the application nozzles 27, 28 illustrated in fig. 3. The metering rods 29, 30, by means of which the excess coating color is doctored off the film rolls 24, 25

again, preferably have depressions on their circumferential surface, for example in the form of circumferential notches or beads, or they have a spiral depression, by means of which the color is picked up from the film rolls 24 or 25 and also metered.

If the film rolls 24, 25 have a large diameter, in particular of more than 1500 mm, they have a lower angular velocity at a predefined web speed of the paper web 2 than in the case of a smaller diameter; as a result, the centrifugal force acting on the coating color applied to the circumferential surface of the film rolls 24, 25 can also be kept within limits, so that misting of the coating color is largely avoided. The coating operation can be carried out at a web speed of more than 1500 m/min, preferably of more than 1700 m/min, in particular of more than 1800 m/min.

In a further alternative, instead of the curtain applicator 17 and instead of the film press 26, a nozzle arrangement 31 (fig. 4) having two nozzle bars 32, 33 extending over the entire width of the paper web 2 is provided, from which the application medium is applied to the paper web 2 so as to be distributed two-dimensionally in the manner of a spray. In this case, there is the possibility of a 1:1 application of the application medium to the paper web 2.

An online process for the production of the paper web can, for example, comprise a press section (1) having at least one press nip, an impingement dryer (13) arranged immediately after the press section (1), a first part of a drying section (34.1), an applicator (17) for applying a coating color in the manner of a curtain or for the film application or for spraying coating color on, and then a second part of a drying section (34.1) (fig. 5).

List of designations

1	Press section
2	Paper web
3	Press nip
4	Press nip
5	Press roll
6	Press roll
7	Shoe press roll
8	Shoe press roll
9	Press felt
10	Press felt
11	Suction roll
12	Supporting roll
13	Impingement dryer
14	Top fabric
15	Bottom fabric
16	Suction roll
17	Applicator
18	Distribution chamber
19	Discharge nozzle
20	Application medium
21	Curtain
22	Supporting roll
23	Layer
24	Film roll
25	Film roll
26	Film press
27	Application nozzle
28	Application nozzle
29	Metering rod
30	Metering rod
31	Nozzle arrangement
32	Nozzle bar
33	Nozzle bar

A	Roll axis
D	Width of the discharge nozzle

d Value before the impingement

H Distance

L Arrow

P Impingement position

s Thickness of the layer

T Vertex

α Angle